Appendix B

River and Levee
Supplemental Site Investigation Report

River and Levee Supplemental Site Investigation Report

Former Maintenance and Fueling Facility

Skykomish, Washington

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1 Introduction

A supplemental soil and sediment investigation was completed in two phases, during September[1] and December[2] 2005, to characterize the extent of petroleum hydrocarbon contamination in the bed of the South Fork Skykomish River and the levee along West River Drive to the west of Fifth Street. This Skykomish River and Levee Supplemental Site Investigation (SSI) Report describes the overall scope and objectives for the investigation, and presents the results. This investigation provided data for developing an Engineering Design Report (EDR) for levee remediation.

1.1 Background

The former railway maintenance and fueling facility in Skykomish is owned and operated by BNSF. Historical activities since the facility opened in the late 1890s included refueling and maintaining locomotives and operating an electrical substation for electric engines. These activities released contaminants to the surrounding environment. BNSF is investigating and remediating the site consistent with the Model Toxics Control Act, RCW 70.105D (MTCA).

Fuel was stored in above and below ground storage tanks at the site until 1974, when most fuel handling activities were discontinued at the Skykomish facility. The site is currently used as a base of operations for track maintenance and snow removal crews.

Railroad Avenue separates BNSF property from the main commercial district of the town. Maloney Creek flows south of BNSF property and west to the South Fork of the Skykomish River. The site encompasses an area of about 40 acres and includes BNSF property and adjacent property. The approximate boundaries of the site are as follows: the Skykomish River to the north, approximately the Old Cascade Highway to the south, Maloney Creek to the west, and approximately Fourth Street to the east.

In early 1991, Ecology designated the former maintenance and fueling facility a high priority cleanup site. Later that year, BNSF indicated a desire to initiate a Remedial Investigation/Feasibility Study (RI/FS) in accordance with MTCA. At that time, formal negotiations for a legal agreement (called an Agreed Order) were initiated. Negotiations were completed in mid-1993. Following a public comment period, the Agreed Order, which includes detailed work plans for the RI/FS process and early interim cleanup work, was signed by Ecology and BNSF. BNSF and Ecology signed a second Agreed

[1] In accordance with the *River and Levee Investigation Work Plan*; RETEC, September 28, 2005.
[2] In accordance with the *Draft Work Plan for Additional Investigation Activities*; RETEC, December 14, 2005.

Order in 2001 for additional interim cleanup work near the Skykomish River and the levee west of Fifth Street.

Investigations performed by BNSF in cooperation with Ecology since 1993 have revealed petroleum contamination in soil, groundwater, sediments and surface water. Detailed information about the scope of prior investigations and the results appear in the 1996 Remedial Investigation Report, in the 2002 Supplemental RI Report, and in the Final Feasibility Study that was submitted in March 2005.

In 2001, BNSF installed a subsurface barrier wall along West River Drive, west of Fifth Street pursuant to Agreed Order No. DE 01TCPNR-2800. The wall was installed to reduce the quantity of total petroleum hydrocarbons (TPH) in the form of mobile free product that seeps into the Skykomish River. Recovery wells were also installed on the upgradient side of the wall and have been recovering oil since installation. Oil seeps have continued since the wall was constructed, and are thought to be from free product contained within the levee behind the barrier wall. The oil seeps occur in the riverbank and are located downgradient from the upland plume. The oil seeps in the river have been restricted to the riverbank and bed within approximately five feet of the riverbank.

Surface sediment samples have been collected from the bank and bed of the South Fork of the Skykomish River; however no deeper samples have been collected. In addition, only two soil samples have been collected from the levee. These samples were collected by Ecology in November 2004.

1.2 Purpose and Objectives

This investigation was intended to provide more precise data regarding the nature and extent of TPH contamination in the levee and within the bed of the Skykomish River for defining the excavation prism for remediation of the levee and adjacent areas. Remedial action in the river and levee areas of the site, if approved by federal permitting agencies, will likely consist of extensive excavation. The data obtained from this investigation will be used to help define the vertical and lateral extent of TPH contamination and therefore the extent of excavation required to meet applicable remediation or cleanup levels.

Boreholes were also advanced around the Skykomish School at Ecology's request. These boreholes were intended to more closely define the western boundary of the free product around the school. The results of this additional sampling will be used in developing a clean up action plan for the Site.

1.3 SSI Report Organization

This report presents the results of an investigation of the nature and extent of TPH contamination in the levee west of the Fifth Street bridge and in the sediments of the Skykomish River, adjacent to the levee. Section 1 describes the background and the purpose and objectives of the investigation. Section 2 discusses the scope of sampling. Section 3 details of the methods used to complete the investigation. Section 4 discusses the subsurface conditions of the areas investigated. Section 5 discusses the analytical results of the investigation. Section 6 discusses the extent of TPH contamination in the levee, the Skykomish River and the western plume boundary near the school. Section 7 presents conclusions and recommendations. Section 8 provides the references cited in the report.

2 Sampling Activities

Subsurface soil and sediment samples were collected for analysis from boreholes advanced through the levee, into the bed of the South Fork Skykomish River, and in areas around the Skykomish School. This section provides the scope of sampling, the rationale behind the borehole locations and the depth of the boreholes and samples.

2.1 Levee Sampling

The investigation of TPH extent in, and under, the levee was conducted in two phases. Phase I was conducted in September 2005 and Phase II was conducted during December 2005. Table 2-1 presents the borehole names, depths, dates of installation and investigation phase.

2.1.1 Phase I Investigation – September 2005

Soil samples were collected from ten locations along the crest of the levee between September 9 and September 14, 2005 (Figure 2-1). These samples were located downgradient of the known product plumes that are delineated upgradient of the barrier wall and upgradient from the riverbank seeps, within areas on the margins of the plumes, and in areas believed to be outside the plumes.

In boreholes in which contamination was evident from visual observations or odor, the boreholes were advanced to the apparent base of the contamination to determine the vertical extent of TPH contamination. Several samples were taken from each borehole and field analyzed using PetroFLAG field-screening test kits to estimate TPH. In general, once the field analysis estimated the depth at which the PetroFLAG test indicated that TPH was at approximately one half of the sediment remediation level, a sample was collected for laboratory verification using NWTPH-Dx analysis to determine depth of TPH exceeding remediation goals. In order to gather additional TPH data, some additional analytical testing was performed from some of the boreholes.

Boreholes in which no contamination was apparent from visual observations or odor were also advanced to approximately the same distance as adjacent borings. Soil samples were collected for analysis from the interval exhibiting the highest PetroFLAG TPH detections.

2.1.2 Phase II – December 2005

An additional seven boreholes were advanced between December 19 and December 22, 2005; four of these boreholes were co-located with Phase I boreholes, while the remaining three boreholes were advanced between previously advanced boreholes.

This second phase of investigation was conducted to supplement the existing dataset obtained from Phase I of the Investigation and provide additional design data for the EDR. The PetroFLAG data and the analytical results (NWTPH-Dx) obtained during Phase I showed a weak correlation with each other and the existing dataset did not provide adequate certainty regarding the total depth of contamination above remediation levels.

During Phase II, soil samples were collected from 2.5 to 5-foot intervals from near the top of the smear zone, to the base of the contamination (or to the depth at which NWTPH-Dx analyses performed under Phase I of the investigation indicate that the TPH contamination is less than the direct contact remediation level (3,400 mg/Kg). Soil samples were not field-screened using PetroFLAG during Phase II.

2.2 South Fork Skykomish River

Sediment samples were collected from 20 boreholes (Figure 2-1) advanced in the bed of the South Fork Skykomish River on September 13 and 14, 2005. These boreholes were located in areas that are submerged during some of the year but were outside the river channel at the time of drilling.

The timing of the investigation was constrained by the regulatory fish window, which permitted activities in the river through September 15, 2005. The river level typically drops to the seasonal low after the fish window ends, and therefore, the drilling and sampling was scheduled for the end of the fish window. However, due to recent precipitation immediately prior to and during the investigation, the extent of available sample locations along the river was limited due to a small rise in the river level. Twenty boreholes were advanced within 50 feet from the toe of the levee; these were located as close as possible to the toe of the levee[3].

Field observations, including visual observations and/or hydrocarbon odor, and PetroFLAG field screening test kits were used to estimate the degree of contamination within the borehole samples. Generally boreholes were profiled by recording observations of visual contamination and any hydrocarbon odor, by collecting soil samples throughout the boring, and by estimating the TPH concentrations in those samples using PetroFLAG field screening test kits. Approximately one verification sample was collected and submitted to Test America (formerly, North Creek Analytical Laboratories, Inc.) for NWTPH-Dx analysis; this sample was typically collected from the depth with the highest apparently concentration of TPH.

If no contamination was apparent from visual or olfactory observations, the boring was field screened for TPH using PetroFLAG test kits. One soil

[3] The River and Levee Investigation Work Plan (RETEC, September 28, 2005) specified a grid of primary borehole locations and contingency borehole locations. While the plan was adhered to as closely as possible, the river level did not allow boreholes to be advanced at all specified locations.

sample was typically collected for analysis from the estimated smear zone interval.

Three in-river borings were selected for additional data collection. Samples were collected from near the center of the potential excavation prism, and from the east and west ends of the prism. These data were collected for input in site-specific calculations regarding the migration of contaminated materials and the scouring of cap materials should the need arise to cap any of the sediments either in the river or under the new levee. In the 3 borings sediment samples were collected for analysis of NWTPH-Dx, total organic carbon (TOC), specific gravity and dry weight (or percent solids). The overall boring depth was determined by estimating the elevation in which contamination appeared in the adjacent borings in the levee.

2.3 Skykomish School

Soil samples were collected from three designated boreholes and two contingency boreholes advanced around the school (Figure 2-1). These boreholes are identified in Table 2-1.

Boreholes located within these plume areas were advanced to the apparent base of the contamination to determine the vertical extent of TPH contamination. Several samples were taken from each borehole and PetroFLAG field-screening test kits were used to estimate TPH. Once the field analysis estimated the depth at which the TPH was at approximately one half of the sediment remediation level, a sample was collected for laboratory verification. In order to determine additional depth information, field analysis was generally conducted from at least two additional depths per borehole.

Soil samples were also collected from the surface soils near the school for lead analysis.

3 Methodology

This section provides the methodology used to advance the boreholes and collect the subsurface soil and sediment samples.

3.1 Drilling Sampling

Soil and sediment samples were collected for description and analysis from boreholes advanced using a minisonic drill rig. Sonic drilling was identified as the most suitable drilling technology for the investigation based on the past success with sonic drilling at the site, the ability of the method to provide highly representative continuous core samples, and because the method enables drilling without introducing drilling fluids. The track-mounted minisonic rig was the most suitable sonic rig for the investigation because of the portability of the rig and its ability to reach difficult to access locations while causing minimal disturbance to the natural surroundings.

The minisonic rig was used to collect continuous soil or sediment samples from each borehole. All drilling equipment was decontaminated between impacted boreholes. The borehole samples were logged and described by a RETEC field geologist, and samples were collected for analysis from select intervals, as described in Section 2. Copies of the boring logs are presented in Appendix A. All drilling locations were exposed (i.e. below OHWM but above the river level) and access to those locations was over dry land and dry riverbed.

Upon completion of Phase I boring activities, a registered land surveyor calculated the coordinates and elevation of the borings in relation to a USGS benchmark. A copy of the survey results are presented in Appendix B. The Phase II boreholes have not been surveyed yet because additional investigation activities are scheduled for January 2006; the Phase II boreholes will be surveyed upon completion of this work.

3.2 PetroFLAG Analysis

The PetroFLAG field portable test method was used for determining TPH concentrations in soil at the site during Phase I of the investigation. This test method was proposed for use at the Site by Ecology because it can determine hydrocarbon contamination levels in real time to help facilitate on site decisions.

The test was performed in three steps: extraction, filtration, and analysis. In the first step a solvent system was used to extract hydrocarbons from the recovered subsurface material. Moisture content had no effect on extraction efficiency. The second step involves filtering out all suspended materials from the extract so that they don't interfere with the test results. Finally, a developing solution was added and the solution extract developed a response

in proportion to the amount of hydrocarbons contained in the soil sample. Within ten minutes the developing solution equilibrated and a reading was obtained using the analyzer. If the type of hydrocarbon is known, then the specific response factor could be selected from the on-board menu to calibrate for the analyte; the response factor selected for PetroFLAG analysis was for diesel range hydrocarbons.

If the reading was above the range detectible by the analyzer then the amount of sample collected was reduced for a diluted reading. Dilution multiplication factors of 2 and 10 times were used at the site. If the sample reading continued to be above the detectible range after 10 times dilution the sample was assumed to have a concentration of greater than 100,000 mg/Kg. When PetroFLAG analysis was complete, the date, time, dilution factor and results were recorded on a field sheet. A copy of the field sheets are presented in Appendix C.

3.3 Laboratory Analysis

The selected verification soil samples collected during drilling activities were logged onto an chain-of-custody form and delivered by RETEC field personnel to Test America (Formerly, North Creek Analytical Laboratories, Inc. (NCA)) for NWTPH-Dx analysis[4]. Select samples were also submitted for analysis of lead and total organic carbon (TOC). A copy of the laboratory analytical results is presented in Appendix D.

In addition, samples of contaminated sediment were collected and retained for use, by prospective vendors, for treatability testing in support of the water treatment processes that may be employed during the remediation activities during summer 2006. These samples have been archived for future use, as necessary.

3.4 Investigation Derived Waste

One of the benefits of sonic drilling is that little waste was generated. All drill cuttings, decontamination water and other investigation-derived waste were drummed and labeled. The drums were transported to a staging area on the railyard, and the drums will remain at the staging area pending disposal.

[4] NWTPH-Dx quantifies petroleum hydrocarbons with carbon ranges between C12 and C36.

4 Subsurface Conditions

Subsurface conditions were further defined in the levee and river during the SSI. This information was used to construct east-west cross sections along the levee and adjacent to the levee, under the Skykomish River channel. The locations of the cross sections are presented in Figure 4-1.

4.1 Levee Subsurface

The upper layer of sediment of the levee subsurface consists of well-graded coarse gravel to cobble sized fill material. This layer varies in depth from approximately 10 to 25 feet bgs. Sample recovery was generally poor in this unit. Underneath this layer discontinuous lenses of silt and clay exist within sand and gravel.

A layer of silt was present within the sand and gravel; however, it did not appear to extend continuously throughout the levee. This layer of silt varies in thickness from 1 to 10 feet and is present from approximately 15 to 35 feet below ground surface.

During the Phase I investigation, groundwater was encountered in the boreholes at depths ranging from 17 feet (LEV-1) to 33 feet (LEV-5). This wide range is due to the variations in surface elevation and lithologic heterogeneities. A cross section of the levee is presented on Figure 4-2.

4.2 River Subsurface

Surficial observations of the South Fork Skykomish River indicated the riverbed surface was armored by cobbles and large boulders. Below the armor, the subsurface sediment is mostly well-graded gravel. A discontinuous silt or clay-rich layer is present at an elevation that varies from 900 to 910 feet msl; this layer varies in thickness to greater than 5 feet. Thin clay, silt and sand discontinuous interbeds are also present within the predominant gravel above and below the silt zone. A cross section of the river is presented on Figure 4-3.

4.3 School Subsurface

The observations of the subsurface near the school were consistent with previous investigations at the site. The soils consisted mainly of sand and gravel, and underneath a generally thin layer of topsoil. There were also discontinuous lenses of silt and clay within the sand and gravel. Little variance occurred in depth to groundwater in this area of the investigation. Depths to groundwater ranged from 8-10 feet below ground surface.

5 Soil Analytical Results

Soil samples were collected and analyzed using PetroFLAG and Laboratory analysis during the field investigation. PetroFLAG and Laboratory analytical results are presented in this section. Laboratory analytical data has not yet been validated.

5.1 Levee Analytical Results

5.1.1 PetroFLAG Results

Fifty-five soil samples were collected for PetroFLAG analysis in the nine borings advanced in the levee. The results of the field screening analysis are summarized in Table 5-1 and plotted on Figure 5-1.

Hydrocarbons were detected in fifty of the fifty-five samples. The reported detected concentrations ranged from 1 mg/Kg to greater than 100,000 mg/Kg.

5.1.2 Laboratory Analytical Results

Ten soil samples were collected for laboratory analysis of TPH by NWTPH-Dx during Phase I of the Investigation and 73 samples were collected during Phase II. The Phase I and II analytical results are summarized in Table 5-2 and 5-3, respectively, and plotted on Figure 5-1. TPH concentrations ranged from concentrations below the method reporting limit (MRL) to 33,500 mg/Kg. The remediation level for TPH was exceeded in eleven soil samples collected from elevations between 916.5 and 907 feet below mean sea level (ft-msl).

5.2 River Sediment Analytical Results

5.2.1 PetroFLAG Results

Sixty-five sediment samples were collected for PetroFLAG analysis in the twenty borings advanced in bank of the river. The results of the field screening analysis are summarized in Table 5-1 and plotted on Figure 5-2.

5.2.2 Laboratory Analytical Results

Twenty-five sediment samples were collected for laboratory analysis of TPH by NWTPH-Dx. The results of samples collected for laboratory analysis are summarized in Table 5-2 and plotted on Figure 5-2.

TPH concentrations ranged from concentrations below the MRL to 576 mg/Kg. The remediation level for TPH was not exceeded in any sample; the cleanup level (22 mg/Kg) was exceeded in six samples.

Six sediment samples were collected for Total Organic Carbon (TOC) analysis. The results of samples collected for laboratory analysis are summarized in Table 5-2. TOC ranged from 1,560 mg/Kg to 5,930 mg/Kg.

5.3 School Soil Analytical Results

5.3.1 PetroFLAG Results

Thirty-one soil samples were collected for PetroFLAG analysis in the five borings advanced around the Skykomish school. The results of the field screening analysis are summarized in Table 5-1.

5.3.2 Laboratory Analytical Results

Seven soil samples were collected for laboratory analysis of TPH by NWTPH-Dx. The results of samples collected for laboratory analysis are summarized in Table 5-2.

TPH concentrations ranged from 22.9 to 3,800 mg/Kg. The remediation level for TPH was exceeded one sample that was collected from 15 to 20 feet bgs from 5-B-8.

Two soil samples were collected, from 5-B-11, for laboratory analysis of lead by EPA 6000/7000 series methods. The results of samples collected for laboratory analysis are summarized in Table 5-2. Lead was detected below cleanup level (250 mg/Kg) in the two samples. Lead was detected at 103 mg/Kg in the soil sample collected from 0 to 1 feet bgs and at 41.9 mg/Kg in the sample collected from 2 to 4 feet bgs.

5.4 Correlation of PetroFLAG and NWTPH-Dx

In general, PetroFLAG results were significantly higher (in some instances over an order of magnitude) than the corresponding laboratory analyzed sample. A statistical analysis was performed to determine if the PetroFLAG data correlated with the laboratory confirmation samples. The results of the analysis are presented in Figure 5-3.

The best correlation was obtained with a power series, using the following equation:

$$y = 4.3399x^{0.9346}$$

The correlation (R^2) using this power series was 0.6783. This indicates a weak correlation between the PetroFLAG field screening data and the laboratory confirmation samples.

The reason for the poor correlation is unclear. One explanation for the higher detections of TPH in the PetroFLAG analysis is the presence of naturally

occurring hydrocarbons in soil which can cause high readings with PetroFLAG. Whatever the reasons, any conclusions drawn from PetroFLAG data will be highly speculative, and for this reason, use of the PetroFLAG data in defining the extent of TPH contamination has been minimal.

6 Extent of Contamination

The data obtained from this investigation has been used to define the vertical and lateral extent of TPH contamination beneath the levee and the Skykomish River, and provide data for the Levee Remediation EDR.

The subsurface sediment samples from around the Skykomish School were collected to more closely define the western boundary of the free product around the school.

6.1 Vertical and Lateral Extent of TPH in the Skykomish Levee

The extent of TPH in the Skykomish Levee has been defined largely based on laboratory analyses using NWTPH-Dx. As described in Section 5.4, the PetroFLAG data have a weak correlation with NWTPH-Dx and as such cannot be used with confidence. Physical observations of the soil samples collected during drilling also provide useful qualitative information regarding the extent of contamination, however the quantitative results obtained from NWTPH-Dx data are the highest quality data and are accordingly given the most weight.

The data indicate that the NWTPH-Dx concentrations appear to be below the direct contact remediation level below 905 ft-msl, and throughout much of the length of the levee, the impacts are restricted to higher elevations. Also, there is an area of the levee that does not appear to be contaminated with petroleum hydrocarbons at concentrations above the remediation level; this area includes boreholes LEV-6A and LEV-7.

The depth of excavation within the levee has been defined, for design purposes, based on the NWTPH-Dx data obtained from this investigation. Further details are provided in the EDR for Levee Remediation.

6.2 Vertical and Lateral Extent of TPH in the Skykomish River

The extent of TPH along the bank of the Skykomish River has been defined based on visual observations and NWTPH-Dx analyses. As described in Section 5.4, the PetroFLAG data have a weak correlation with NWTPH-Dx and as such cannot be used with confidence. Physical observations of the soil samples collected during drilling also provide useful qualitative information regarding the extent of contamination, however the quantitative results obtained from NWTPH-Dx data are the highest quality data and are accordingly given the most importance.

The investigation data indicates that TPH contamination appears to be restricted to the riverbed within 10 feet of the toe of the levee as shown by LEV-10 and LEV-3, and a limited area on the west end of the levee, as defined by RIV-2 and RIV-3. NAPL was observed in the upper four inches in LEV-2, LEV-3 and LEV-10 and elevated TPH concentrations were detected in some deeper sediment samples from these boreholes.

7 Conclusions and Recommendations

The data obtained during this investigation have been used to define the vertical and lateral extent of TPH contamination beneath the levee, the Skykomish River, and to provide additional definition of contamination around the margin of the Skykomish School.

The levee investigation was performed in two phases because the initial phase of the investigation, conducted during September 2005, yielded ambiguous data, primarily due to a weak correlation between the majority of the TPH data that was provided by a field screening test (PetroFLAG) and NWTPH-Dx samples. The data from the two phases were combined to provide a more complete understanding of the vertical and lateral extent of TPH underlying the levee. The data show that TPH concentrations in excess of the remediation level may extend to a minimum elevation of 905 ft-msl under the western half of the levee, and that this contamination is separated from contamination under the eastern quarter of the levee by a relatively clean zone that corresponds to the un-impacted upland area that is immediately upgradient from the levee. TPH contamination above the remediation level in the eastern quarter of the levee appears to extend to a minimum elevation of approximately 910 to 915 ft-msl.

The analysis of data collected from the riverbed concluded that NAPL was present in the upper four inches of sediment in RIV-2, RIV-3 and RIV-10; however testing did not measure TPH at a concentration exceeding the RL in any sediment samples. Generally, TPH concentrations in the riverbed are less than the cleanup levels, and there are no signs of contamination. However, TPH impacts at concentrations above the CUL are suspected in some discrete areas of the riverbed. These areas include the following: (1) an area just west of the 5th Street bridge encompassing RIV-2 and RIV-3. This area contains TPH impacts (above the CUL) to an elevation of approximately 907 ft-msl; (2) the area around RIV-10, this borehole also showed TPH impacts above the CUL to an approximate elevation of 907 ft-msl.

Finally, a borehole advanced beneath the bridge (RIV-20) contained TPH at a concentration (43 mg/Kg) greater than the soil CUL in the top one foot of sediment. The source of this TPH is unknown, since sediment in this area may be impacted by stormwater runoff from a nearby culvert that drains portions of the Town of Skykomish and discharges into the river near the bridge. This borehole location is outside the currently-proposed remediation area.

8 References

GeoEngineers, 1993. *Remedial Investigation/Feasibility Study Work Plan: Burlington Northern Railroad Maintenance and Fueling Facility, Skykomish, Washington.* Tacoma, Washington: GeoEngineers. July 1993.

RETEC, 1996. *Remedial Investigation for the Former Maintenance and Fueling Facility in Skykomish, Washington.* Seattle, Washington: Remediation Technologies, Inc. January 1996.

RETEC, 1999. *Feasibility Study – BNSF Former Maintenance and Fueling Facility, Skykomish, Washington.* Seattle, Washington: ThermoRetec Consulting Corporation, October 14, 1999.

RETEC, 2001. *Interim Action Basis of Design for LNAPL Barrier System: Former BNSF Fueling and Maintenance Facility, Skykomish, Washington, Vol. 1 of 2.* Seattle, Washington: The RETEC Group, Inc. August 10, 2001.

RETEC, 2002. *Supplemental Remedial Investigation: BNSF Former Maintenance and Fueling Facility, Skykomish, Washington.* Seattle, Washington: The RETEC Group, Inc. July 12, 2002.

RETEC, 2003. *Final Draft Feasibility Study and Environmental Impact Statement: BNSF Former Maintenance and Fueling Facility, Skykomish, Washington.* Seattle, Washington: The RETEC Group, Inc., September 3, 2003.

RETEC, 2005. *Site-Specific Health and Safety Plan, Former Fueling and Maintenance Facility, Skykomish, Washington.* April 29, 2005.

Tables

Table 2-1 Borehole Details

Borehole ID	Investigation Area	Total Depth (ft)	Installation Date	Investigation Phase
LEV-1	Levee	20	9/9/2005	Phase I
LEV-2	Levee	20	9/9/2005	Phase I
LEV-3	Levee	35	9/9/2005	Phase I
LEV-4	Levee	50	9/12/2005	Phase I
LEV-5	Levee	60	9/11/2005	Phase I
LEV-5B	Levee	55	9/16/2005	Phase I
LEV-6	Levee	50	9/14/2005	Phase I
LEV-7	Levee	50	9/15/2005	Phase I
LEV-8	Levee	52	9/15/2005	Phase I
LEV-9	Levee	50	9/15/2005	Phase I
LEV-2A	Levee	40	12/22/2005	Phase II
LEV-4A	Levee	35	12/22/2005	Phase II
LEV-5C	Levee	35	12/21/2005	Phase II
LEV-6A	Levee	45	12/21/2005	Phase II
LEV-7A	Levee	35	12/20/2005	Phase II
LEV-8A	Levee	35	12/19/2005	Phase II
LEV-8B	Levee	35	12/20/2005	Phase II
5-B-7	School	35	9/10/2005	Phase I
5-B-8	School	35	9/10/2005	Phase I
5-B-9	School	30	9/10/2005	Phase I
5-B-11	School	30	9/11/2005	Phase I
5-B-12	School	35	9/11/2005	Phase I
RIV-1	River	10	9/12/05	Phase I
RIV-2	River	10	9/12/05	Phase I
RIV-3	River	12	9/12/05	Phase I
RIV-4	River	23	9/12/05	Phase I
RIV-5	River	15	9/13/05	Phase I
RIV-6	River	15	9/13/05	Phase I
RIV-7	River	15	9/13/05	Phase I
RIV-8	River	15	9/13/05	Phase I
RIV-9	River	15	9/13/05	Phase I
RIV-10	River	25	9/13/05	Phase I
RIV-11	River	15	9/13/05	Phase I
RIV-12	River	25	9/13/05	Phase I
RIV-13	River	15	9/13/05	Phase I
RIV-14	River	15	9/14/05	Phase I
RIV-15	River	15	9/14/05	Phase I
RIV-16	River	15	9/14/05	Phase I
RIV-17	River	15	9/14/05	Phase I
RIV-18	River	15	9/14/05	Phase I
RIV-19	River	15	9/14/05	Phase I
RIV-20	River	15	9/14/05	Phase I

Table 5-1 Summary of PetroFLAG Field Screening Results

Sample Location	PetroFLAG Result (mg/Kg)
5-B-7 - 6-7'	> 100,000
5-B-7 - 10-13'	10,280
5-B-7 - 15-20'	578
5-B-7 - 20-25'	1898
5-B-7 - 25-28'	342
5-B-7 - 28-30'	38
5-B-8 - 8'	7,550
5-B-8 - 12'	9,720
5-B-8 - 15-20'	7,600
5-B-8 - 20-25'	990
5-B-8 - 29-30'	27
5-B-9 - 7'	2,751
5-B-9 - 12'	1,130
5-B-9 - 17'	4,770
5-B-9 - 22'	1,186
5-B-9 - 26'	564
5-B-9 - 29'	53
5-B-11 - 5-10'	49
5-B-11 - 10-15'	85
5-B-11 - 15-20'	269
5-B-11 - 20-25'	57
5-B-11 - 25-27'	0
5-B-11 - 27-30'	0
5-B-12 - 6-10'	11,890
5-B-12 - 13'	2,830
5-B-12 - 15'	17
5-B-12 - 15-20'	580
5-B-12 - 20-25'	3,490
5-B-12 - 25-30'	940
5-B-12 - 30-33'	1,260
5-B-12 - 34-35'	0
LEV-1 - 16-19'	2,330
LEV-2 - 18'	9,400
LEV-2 - 19'	5,820

Sample Location	PetroFLAG Result (mg/Kg)
LEV-3 - 15.5-19.5'	10,310
LEV-3 - 21-25'	110
LEV-4 - 15'	> 100,000
LEV-4 - 25-30'	11,000
LEV-4 - 30-35'	7,640
LEV-4 - 35-39'	1,650
LEV-4 - 39-40'	0
LEV-4 - 40-45'	3
LEV-4 - 45-50'	8
LEV-5 - 29-30'	7,010
LEV-5 - 32-35'	119
LEV-5 - 35-40'	3,270
LEV-5 - 42'	212
LEV-5 - 45'	409
LEV-5 - 50-55'	130
LEV-5 - 55-60'	126
LEV-5B - 15'	> 100,000
LEV-5B - 20'	> 100,000
LEV-5B - 25'	3,050
LEV-5B - 30'	150
LEV-5B - 33'	0
LEV-5B - 38'	702
LEV-5B - 43'	6,730
LEV-5B - 46'	1
LEV-5B - 55'	0
LEV-6 - 5'	7
LEV-6 - 28'	0
LEV-6 - 30'	25
LEV-6 - 33'	9,190
LEV-6 - 43'	12
LEV-6 - 47'	57
LEV-7 - 7'	27
LEV-7 - 23'	106
LEV-7 - 33'	52

Sample Location	PetroFLAG Result (mg/Kg)
LEV-7 - 38'	50
LEV-7 - 45'	48
LEV-7 - 47'	29
LEV-7 - 50'	16
LEV-8 - 10	21,320
LEV-8 - 12	47
LEV-8 - 16	> 100,000
LEV-8 - 25	14,450
LEV-8 - 35	3,160
LEV-8 - 43	77
LEV-8 - 50'	80
LEV-9 - 14'	26
LEV-9 - 23'	1,168
LEV-9 - 25'	61
LEV-9 - 33'	269
LEV-9 - 41'	342
LEV-9 - 46'	465
LEV-9 - 50'	24
RIV-2 - 0-1'	5,700
RIV-2 - 10'	18
RIV-3 - 0-5'	1,750
RIV-3 - 5-10'	4,880
RIV-3 - 15'	44
RIV-4 - 0-4'	201
RIV-4 - 4-10'	143
RIV-4 - 10-15'	144
RIV-4 - 15-18'	139
RIV-4 - 18-20'	0
RIV-4 - 20-23'	0
RIV-5 - 0-3'	6
RIV-5 - 3-5'	90
RIV-5 - 5-10'	182
RIV-5 - 13-14'	42
RIV-5 - 14-15'	15

Sample Location	PetroFLAG Result (mg/Kg)
RIV-6 - 0-3'	32
RIV-6 - 3-5'	21
RIV-7 - 0-5'	155
RIV-7 - 5-10'	10
RIV-7 - 10-13'	72
RIV-7 - 13-15'	48
RIV-8 - 0-2'	31
RIV-8 - 4-6'	12
RIV-8 - 15'	95
RIV-9 - 0-5'	0
RIV-9 - 5-10'	38
RIV-9 - 12-15'	18
RIV-10 - 10-12'	17
RIV-10 - 12-14'	35
RIV-10 - 15-20'	17
RIV-10 - 20-21'	33
RIV-10 - 21-25'	16
RIV-11 - 5-10'	3
RIV-11 - 10-13'	75
RIV-11 - 13-15'	29
RIV-12 - 5'	10
RIV-12 - 10'	585
RIV-12 - 14'	19
RIV-12 - 16'	0
RIV-12 - 25'	9
RIV-13 - 3'	4
RIV-13 - 15'	1
RIV-14 - 1'	109
RIV-14 - 9'	7
RIV-14 - 15'	6
RIV-15 - 1'	219
RIV-15 - 6'	9
RIV-15 - 8'	0
RIV-15 - 15'	86

Sample Location	PetroFLAG Result (mg/Kg)
RIV-16 - 1'	50
RIV-16 - 9'	30
RIV-16 - 15'	12
RIV-17 - 1'	7
RIV-17 - 7'	26
RIV-17 -15'	5
RIV-18 - 1'	13
RIV-18 - 10'	9
RIV-18 - 15'	61
RIV-19 - 1'	27
RIV-19 - 11'	66
RIV-19 - 15'	35
RIV-20 - 1'	79
RIV-20 - 8'	5
RIV-20 - 15'	0

Table 5-2 Summary of Laboratory Analytical Results – Phase I Investigation

Levee Analytical Results

Compound	Method	LEV-1 18-19' 9/9/2005	LEV-2 19' 9/9/2005	LEV-3 21-25' 9/9/2005	LEV-4 35-39' 9/12/2005	LEV-5 35-40' 9/11/2005	LEV-5B 39' 9/16/2005	LEV-5B 43' 9/16/2005	LEV-6 47' 9/14/2005	LEV-8 35' 9/15/2005	LEV-9 23' 9/15/2005
Diesel Range Hydrocarbons	NWTPH-Dx	1740	1430	380	95.9	ND	186	961	8.13	311	367
Lube Oil Range Hydrocarbons	NWTPH-Dx	2010	1770	475	130	4.43	234	1160	9.33	386	487
Total Petroleum Hydrocarbons	NWTPH-Dx	3750	3200	855	225.9	4.43	420	2121	17.46	697	854
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

River Analytical Results

Compound	Method	RIV-2 0-1' 9/12/2005	RIV-3 5-10' 9/12/2005	RIV-4 15-18' 9/12/2005	RIV-5 0-3' 9/14/2005	RIV-6 0-3' 9/14/2005	RIV-7 0-5' 9/14/2005	RIV-8 0-2' 9/14/2005	RIV-9 0-5' 9/14/2005	RIV-10 10-12' 9/14/2005	RIV-11 5-10' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	201	41.2	ND	2.54	1.6	2.43	ND	ND	11.1	3.55
Lube Oil Range Hydrocarbons	NWTPH-DX	375	91.2	5.03	5.14	3.19	7	ND	3.29	12.4	5.31
Total Petroleum Hydrocarbons	NWTPH-Dx	576	132.4	5.03	7.68	4.79	9.43	ND	3.29	23.5	8.86
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Compound	Method	RIV-12 0-5' 9/14/2005	RIV-12 3' 9/13/2005	RIV-12 14' 9/13/2005	RIV-13 3' 9/14/2005	RIV-14 1' 9/14/2005	RIV-15 1' 9/14/2005	RIV-16 1' 9/14/2005	RIV-17 1' 9/14/2005	RIV-17 3' 9/14/2005	RIV-17 13' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	5.28	2.28	ND	1.76	2.23	4.1	1.85	ND	ND	1.96
Lube Oil Range Hydrocarbons	NWTPH-DX	6.43	8.03	6.63	ND	7.18	16.8	4.27	ND	ND	5.48
Total Petroleum Hydrocarbons	NWTPH-Dx	11.71	10.31	6.63	1.76	9.41	20.9	6.12	ND	ND	7.44
Lead	6000/7000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	2280	3660	NA	NA	NA	NA	NA	2100	4380

Compound	Method	RIV-18 1' 9/14/2005	RIV-19 1' 9/14/2005	RIV-20 1' 9/14/2005	RIV-20 3' 9/14/2005	RIV-20 13' 9/14/2005
Diesel Range Hydrocarbons	NWTPH-DX	2.88	2.03	8.04	5.64	3.04
Lube Oil Range Hydrocarbons	NWTPH-DX	7.4	5.34	35.4	16.8	10.7
Total Petroleum Hydrocarbons	NWTPH-Dx	10.28	7.37	43.44	22.44	13.74
Lead	6000/7000	NA	NA	NA	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	2800	5490

School Adjacent Analytical Results

Compound	Method	5-B-7 20-25' 9/10/2005	5-B-8 15-20' 9/10/2005	5-B-9 22' 9/10/2005	5-B-11 0-1' 9/11/2005	5-B-11 2-4' 9/11/2005	5-B-11 15-20' 9/11/2005	5-B-12 30-33' 9/11/2005
Diesel Range Hydrocarbons	NWTPH-DX	383	1550	282	10.9	15.7	3.21	36.9
Lube Oil Range Hydrocarbons	NWTPH-DX	567	2250	366	86.8	62.9	19.7	92.6
Total Petroleum Hydrocarbons	NWTPH-Dx	950	3800	648	97.7	78.6	22.91	129.5
Lead	6000/7000	NA	NA	NA	103	41.9	NA	NA
Total Organic Carbon	APHA/EPA Average	NA	NA	NA	NA	NA	NA	NA

ND = Not Detected and the Method Reporting Limit
NA = Not Analyzed

Table 5-3 Summary of Laboratory Analytical Results – Phase II Investigation

			NWTPH-Dx (mg/Kg)		
ID	**Sample Date**	**Depth**	**TPH-D**	**TPH-O**	**NWTPH-Dx**
LEV2A	12/22/2005	10	161	231	392
LEV2A	12/22/2005	15	10800	13500	24300
LEV2A	12/22/2005	17.5	1600	1650	3250
LEV2A	12/22/2005	20	ND	ND	ND
LEV2A	12/22/2005	22.5	83.4	105	188.4
LEV2A	12/22/2005	25	ND	ND	ND
LEV2A	12/22/2005	30	ND	ND	ND
LEV2A	12/22/2005	32.5	ND	ND	ND
LEV2A	12/22/2005	35	ND	ND	ND
LEV2A	12/22/2005	37.5	108	126	234
LEV2A	12/22/2005	40	40.3	54.4	94.7
LEV4A	12/22/2005	10	ND	ND	ND
LEV4A	12/22/2005	15	47	89.3	136.3
LEV4A	12/22/2005	17.5	2780	2270	5050
LEV4A	12/22/2005	20	1990	1910	3900
LEV4A	12/22/2005	22.5	2090	1940	4030
LEV4A	12/22/2005	25	385	378	763
LEV4A	12/22/2005	27.5	21.7	ND	21.7
LEV4A	12/22/2005	30	ND	ND	ND
LEV4A	12/22/2005	32.5	40.3	44.9	85.2
LEV4A	12/22/2005	35	23.7	ND	23.7
LEV5C	12/21/2005	10	ND	ND	ND
LEV5C	12/21/2005	15	18900	14600	33500
LEV5C	12/21/2005	17.5	4620	3910	8530
LEV5C	12/21/2005	20	9740	8290	18030
LEV5C	12/21/2005	22.5	124	118	242
LEV5C	12/21/2005	25	ND	ND	ND
LEV5C	12/21/2005	27.5	ND	ND	ND
LEV5C	12/21/2005	30	ND	ND	ND
LEV5C	12/21/2005	32.5	ND	ND	ND
LEV5C	12/21/2005	35	ND	ND	ND
LEV6A	12/21/2005	10	ND	ND	ND
LEV6A	12/21/2005	15	33.5	75.8	109.3
LEV6A	12/21/2005	17.5	ND	ND	ND
LEV6A	12/21/2005	20	ND	ND	ND
LEV6A	12/21/2005	22.5	ND	ND	ND
LEV6A	12/21/2005	25	ND	ND	ND
LEV6A	12/21/2005	27.5	ND	ND	ND
LEV6A	12/21/2005	30	ND	ND	ND
LEV6A	12/21/2005	32.5	ND	ND	ND
LEV6A	12/21/2005	35	ND	ND	ND
LEV6A	12/21/2005	37.5	ND	ND	ND
LEV6A	12/21/2005	40	ND	ND	ND
LEV6A	12/21/2005	42.5	ND	ND	ND
LEV6A	12/21/2005	45	ND	ND	ND

Table 5-3 Summary of Laboratory Analytical Results – Phase II Investigation

			NWTPH-Dx (mg/Kg)		
ID	**Sample Date**	**Depth**	**TPH-D**	**TPH-O**	**NWTPH-Dx**
LEV7A	12/20/2005	10	963	2270	3233
LEV7A	12/20/2005	15	2080	2490	4570
LEV7A	12/20/2005	17.5	1770	1440	3210
LEV7A	12/20/2005	20	ND	ND	ND
LEV7A	12/20/2005	22.5	17.4	ND	17.4
LEV7A	12/20/2005	25	ND	ND	ND
LEV7A	12/20/2005	27.5	ND	ND	ND
LEV7A	12/20/2005	30	129	130	259
LEV7A	12/20/2005	32.5	ND	ND	ND
LEV7A	12/20/2005	35	ND	ND	ND
LEV8A	12/19/2005	10	ND	ND	ND
LEV8A	12/19/2005	15	47.2	54.9	102.1
LEV8A	12/19/2005	17.5	879	866	1745
LEV8A	12/19/2005	20	3070	2540	5610
LEV8A	12/19/2005	25	60.2	54.4	114.6
LEV8A	12/19/2005	30	18.1	ND	18.1
LEV8A	12/19/2005	32.5	ND	ND	ND
LEV8A	12/19/2005	35	35	30	65
LEV8B	12/20/2005	10	48.6	107	155.6
LEV8B	12/20/2005	15	1320	1420	2740
LEV8B	12/20/2005	17.5	3140	2660	5800
LEV8B	12/20/2005	20	11.9	ND	11.9
LEV8B	12/20/2005	22.5	ND	ND	ND
LEV8B	12/20/2005	25	ND	ND	ND
LEV8B	12/20/2005	27.5	12.9	ND	12.9
LEV8B	12/20/2005	30	ND	ND	ND
LEV8B	12/20/2005	32.5	ND	ND	ND
LEV8B	12/20/2005	35	ND	ND	ND

Note:
ND Not Detected at the Method Reporting Limit

Figures

ROCK SHELF

LARGE ROCKS

riv-19 916.90
riv-18 917.31
riv-2 917.18
riv-3 917.38
riv-1 917.40
riv-20 918.01
riv-4 917.33
riv-5 917.02
riv-6 916.60
riv-7 916.50
riv-8 916.57
riv-9 916.65
riv-11 916.17
riv-12 916.58
riv-16 916.27
riv-13 916.08
riv-14 916.29
riv-15 916.30
riv-17 915.47
riv-10 916.56

lev-1 925.72
lev-2A
lev-2 930.61
lev-3 930.35
lev-4A
lev-4 930.54
lev-5 930.77
lev-5B 930.76
lev-5C
lev-6 930.34
lev-6A
lev-7 931.57
lev-7A
lev-8B
lev-8 931.80
lev-8A
lev-9 932.5

BARRIER WALL

KINGCO "GPS 8823 1995"

6TH ST.

5TH ST.

RAILROAD

LEGEND

- ● riv-12 916.58 — PHASE I INVESTIGATION BOREHOLE LOCATION, GROUND SURFACE ELEVATION IN FT-MSL
- ◎ lev-4A — PHASE II INVESTIGATION BOREHOLE LOCATION

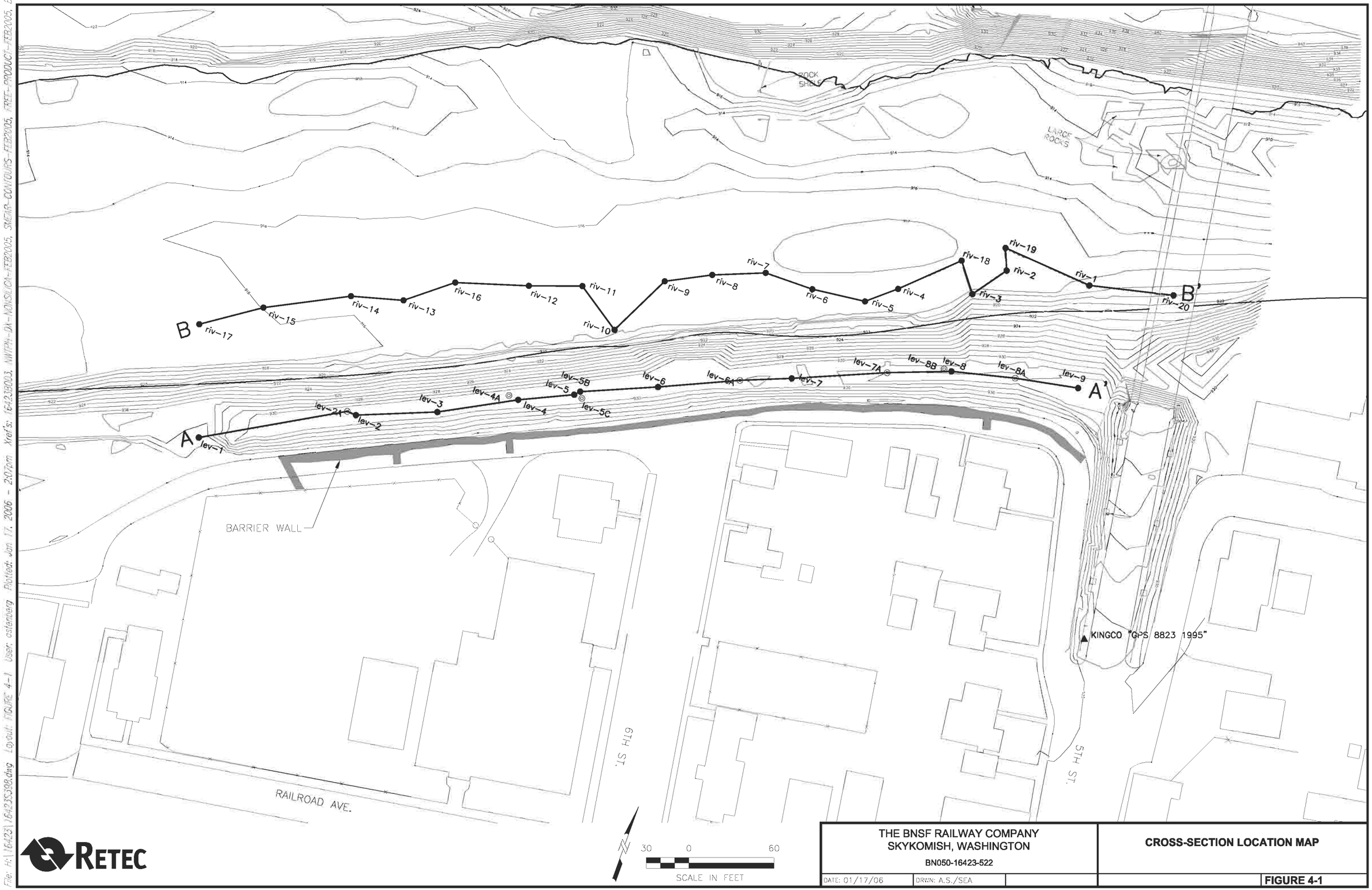
N

30 0 60

SCALE IN FEET

RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522			**BOREHOLE LOCATION MAP**
DATE: 01/17/06	DRWN: A.S./SEA		**FIGURE 2-1**



RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522			**CROSS-SECTION LOCATION MAP**
DATE: 01/17/06	DRWN: A.S./SEA		**FIGURE 4-1**

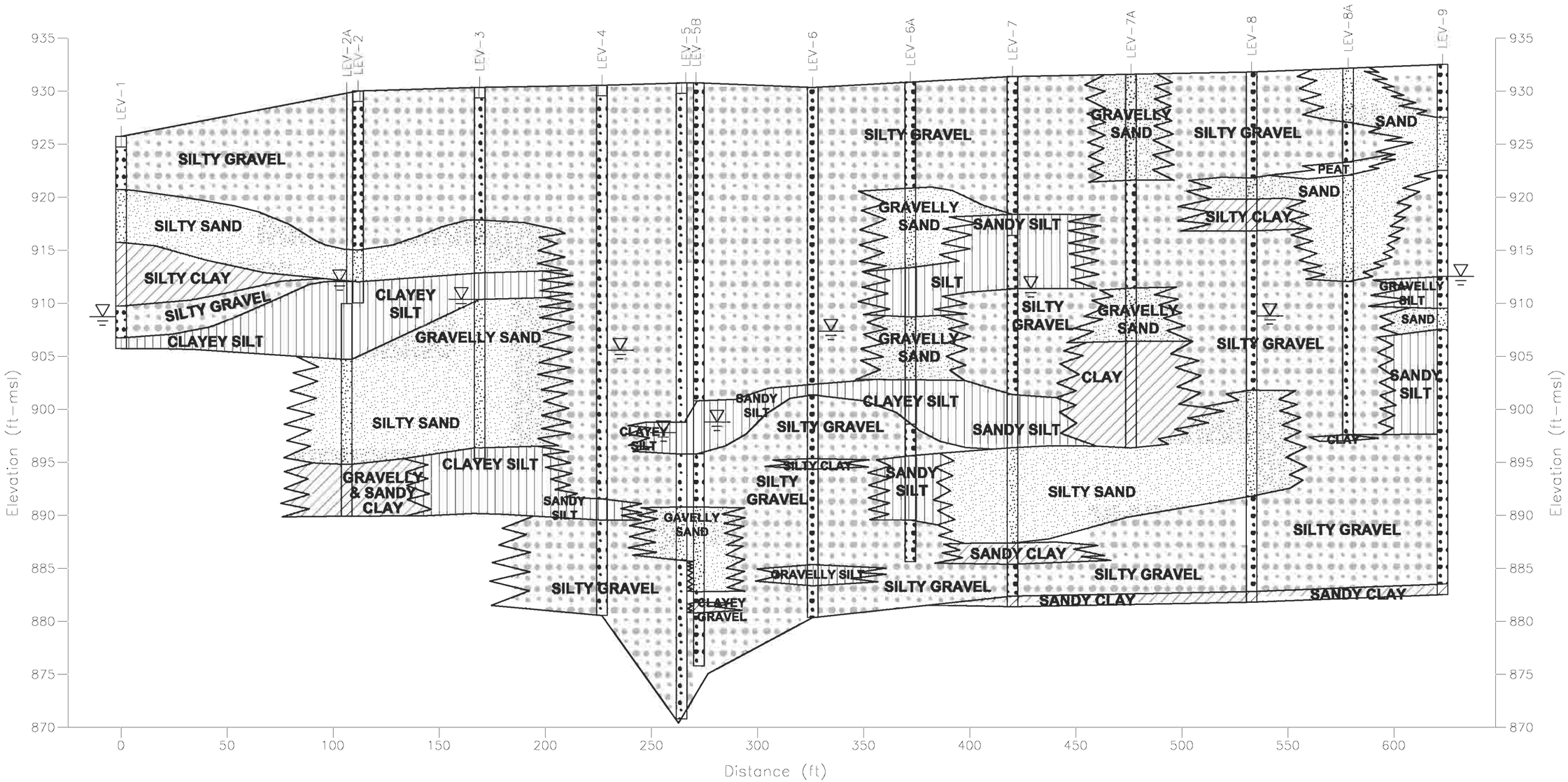
File: H:\16423\16423S398.dwg Layout: FIGURE 4-1 User: astanberg Plotted: Jan 17, 2006 - 2:07pm Xref's: 16423S003, NWTPH-DX-NONSUIOM-FEB2005, SNEHR-CONTOURS-FEB2005, TREE-PRODUCT-FEB2005, B

WEST

A

EAST

A'



LEGEND

- CLAY
- SAND
- GRAVEL
- SILT
- WATER LEVEL

25 0 50

HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 5

NOTE: Section is not projected, it is shown as direct distance

RETEC

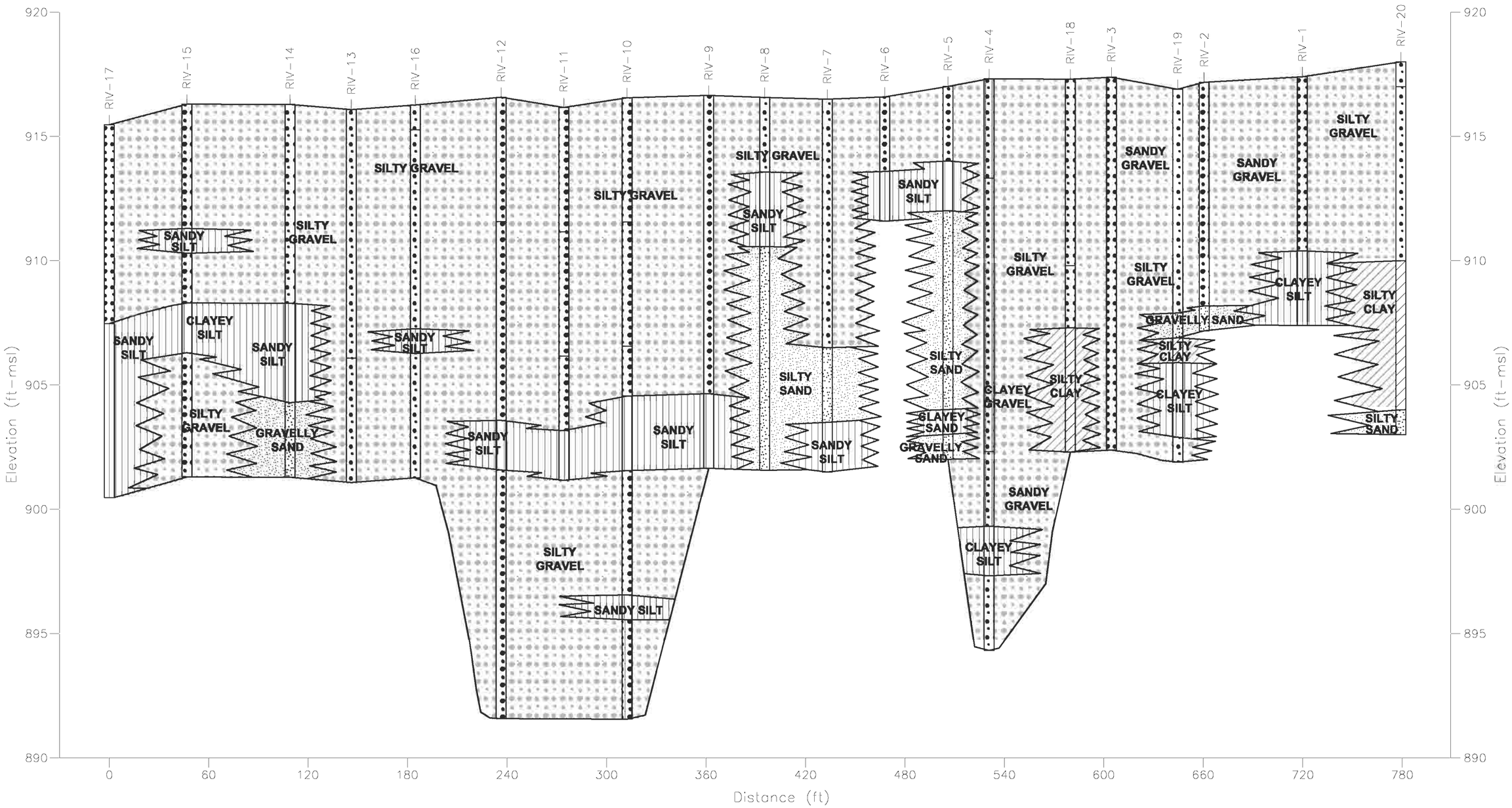
THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522			CROSS-SECTION A-A'
DATE: 01/16/06	DRWN: A.S./SEA		FIGURE 4-2

WEST

B

EAST

B'



LEGEND

- CLAY
- SAND
- SILT
- GRAVEL

30 0 60

HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 15

NOTE: Section is not projected, it is shown as direct distance

RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522			CROSS-SECTION B-B'
DATE: 01/17/06	DRWN: A.S./SEA		FIGURE 4-3

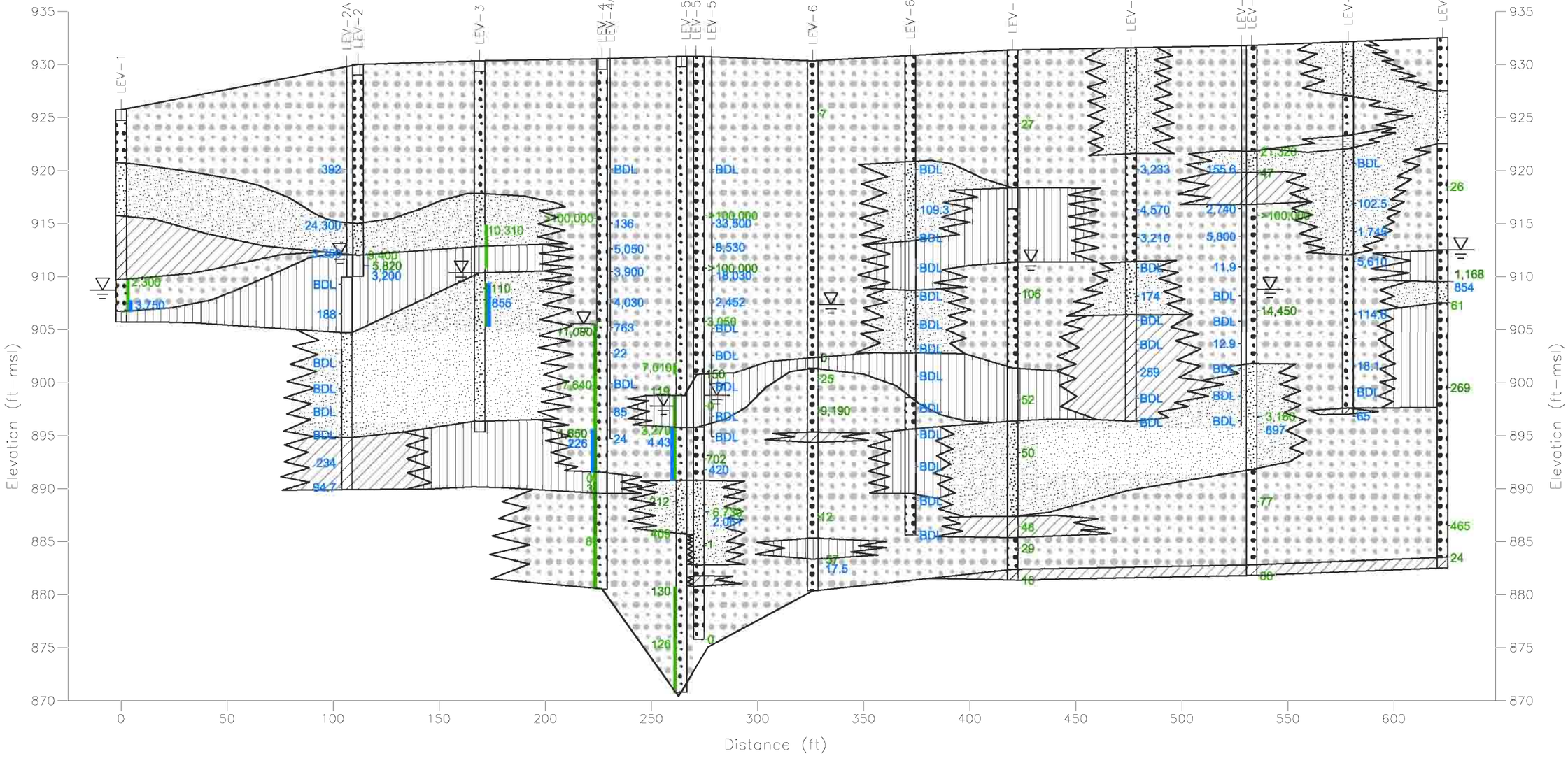
File: H:\16423\16423001.dwg Layout: FIGURE 4-3 User: astenberg Plotted: Jan 17, 2006 - 2:10pm Xref's:

WEST

A

EAST

A'



LEGEND

CLAY
SAND
GRAVEL
SILT
WATER LEVEL

Petro FLAG data (mg/kg)
NWTPH-Dx (mg/kg)

25 0 50
HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 5

NOTE: Section is not projected, it is shown as direct distance

RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522	**CROSS-SECTION A-A' WITH ANALYTICAL RESULTS**
DATE: 01/16/06 | DRWN: A.S./SEA	**FIGURE 5-1**

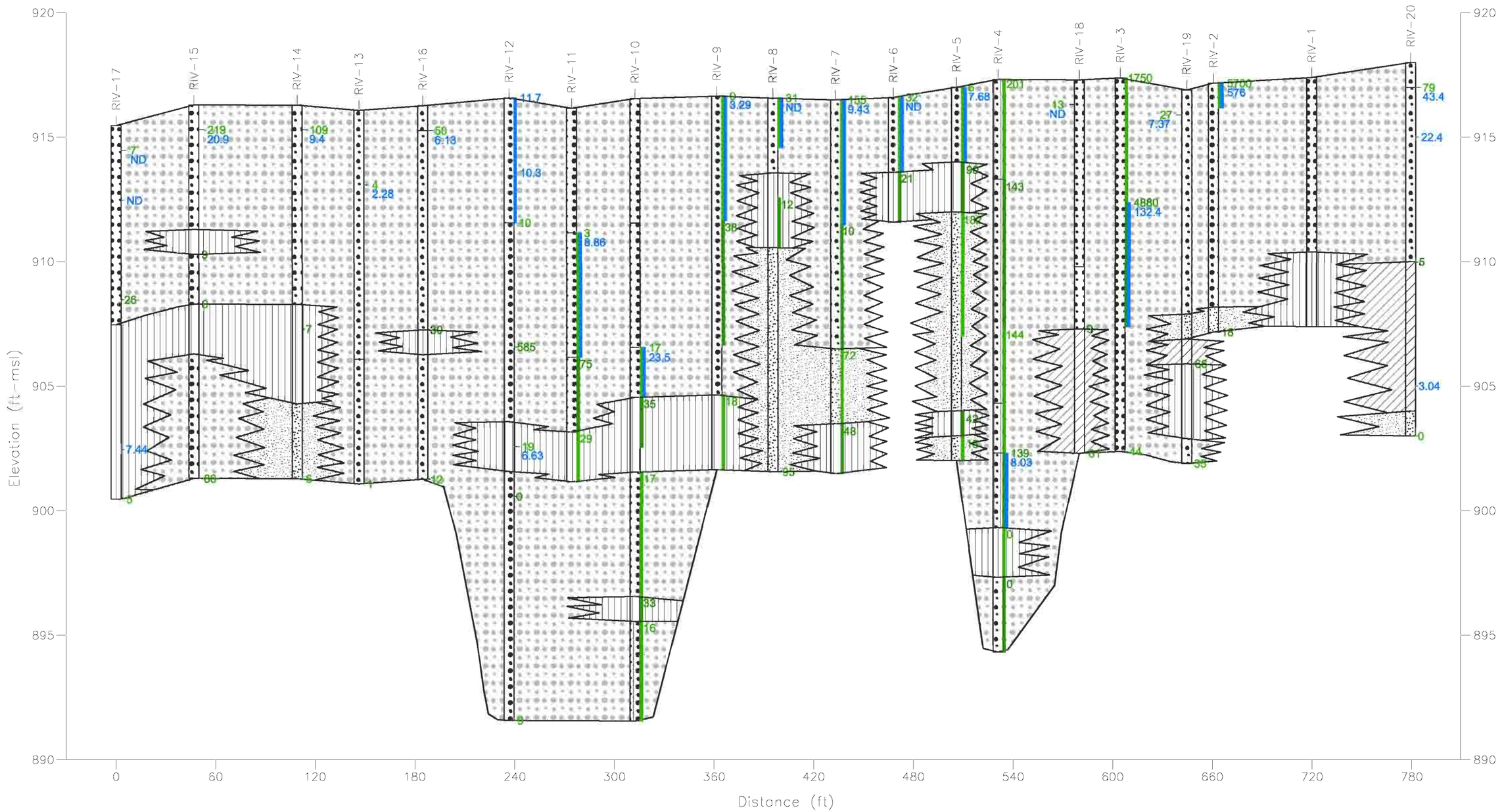
File: H:\16423\16423015.dwg Layout: ROUTE 5-1 User: ostenberg Plotted: Jan 17, 2006 - 2:12pm Kret's:

WEST

B

EAST

B'



LEGEND

- CLAY
- SAND
- SILT
- GRAVEL

Petro FLAG data (mg/kg)
NWTPH-Dx (mg/kg)

30 0 60
HORIZONTAL SCALE IN FEET
Vertical Exaggeration: 15

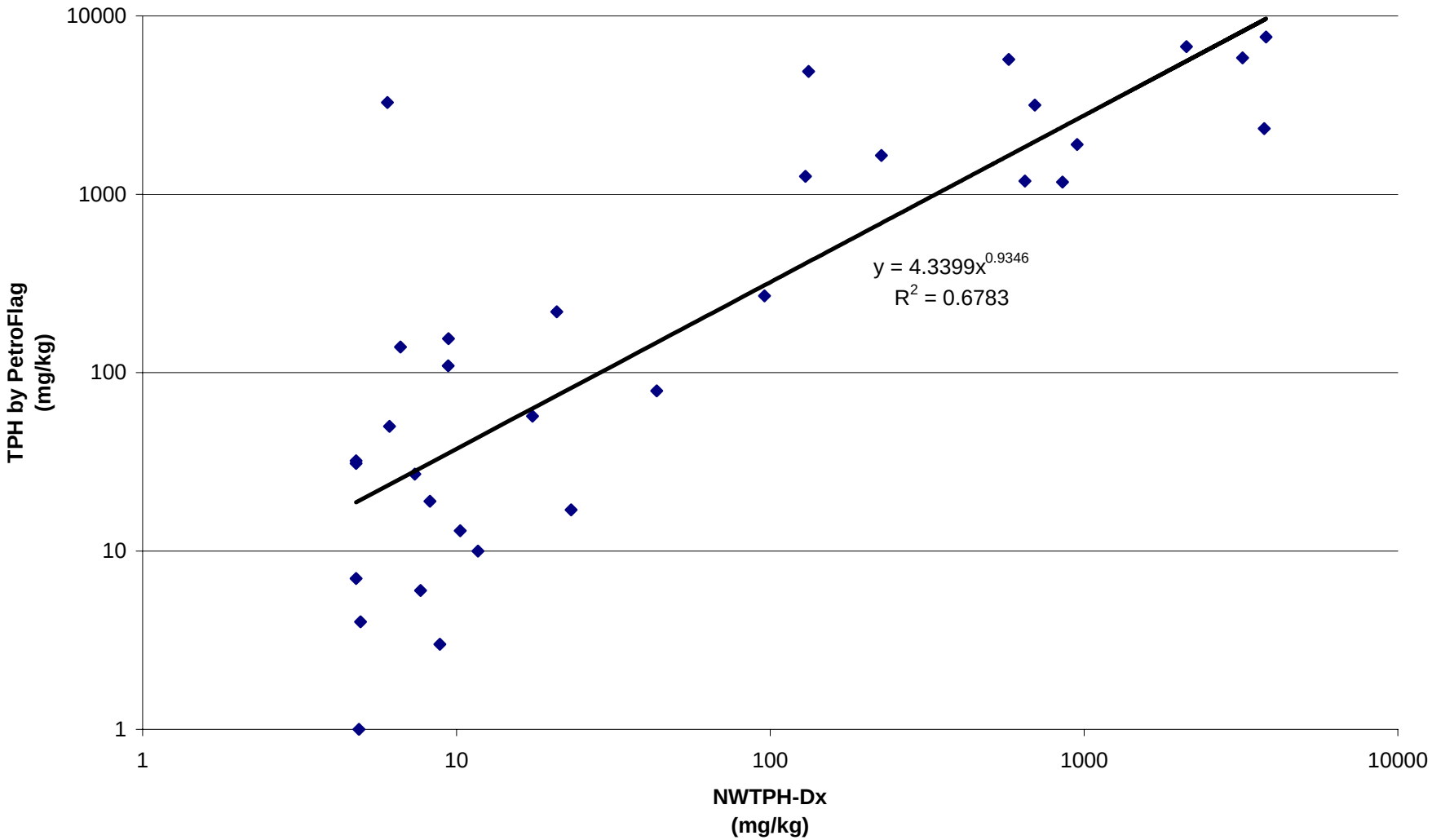
NOTE: Section is not projected, it is shown as direct distance

RETEC

THE BNSF RAILWAY COMPANY SKYKOMISH, WASHINGTON BN050-16423-522			**CROSS-SECTION B-B' WITH ANALYTICAL RESULTS**
DATE: 01/17/06	DRWN: A.S./SEA		**FIGURE 5-2**

File: H:\16423\16423016.dwg Layout: FIGURE 5-2 User: csteinberg Plotted: Jan 17, 2006 - 2:16pm Xref's:

Figure 5-3
Field Screening Results (PetroFlag) vs NWTPH-Dx



Appendix A

Soil Boring Logs

Appendix B

Surveyors Report

Appendix C

PetroFLAG Field Sheets

Appendix D

Laboratory Analytical Data